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12.—THOMAS WHARTON JONES

BY

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Concluded.

The last ten years of Wharton Jones's life in London did not produce any further contribution to science, unless we consider the two lectures on evolution delivered at University College, in October, 1874, and October, 1875, as real contributions to science. They were published in 1876 and were referred to when we were trying to form a preliminary estimate of his character and mental outlook. Here we need only remind ourselves of the line of his argument and of his unswerving orthodoxy by the following quotations: "The question of the *Origin of Man*, it must be concluded, is one entirely beyond the pale of Natural Science. But when, where, and howsoever his first advent on the earth took place, this much is certain, that there are no valid grounds in support of the thesis that he ever existed under any other presentment or embodiment than that of *Man*."

His opinion of Darwin and his followers is shown in the last paragraph of the first lecture. He has been comparing evolutionists to the Schoolmen of the dark ages, who "lost themselves in trying to make of the Philosophy of Aristotle what it was not;" and he

goes on: "The result in this case being as unprofitable as the Quiddities of the Schoolmen, we may, perhaps not unjustly, apply to the followers of Darwin the Poet's censure of the 'Sons of Aristotle:'

> "They stand
> Locked up together hand in hand.
> Everyone leads as he is led:
> The same bare path they tread,
> And dance like fairies a fantastic round,
> But neither change their motion, nor their ground."

Darwin, Wallace, and Haeckel shocked many good people, or, at all events, disturbed their peace of mind, to an extent which it is now difficult for us to appreciate. To them, therefore, counter-blasts from men of science, like that of Jones, were welcome and soothing; but for his fellow workers it was sad to see one who had been so active a pioneer taking up such a stationary and uncompromising attitude, and showing in other ways that he was out of sympathy with the irresistible progress of science. This critical and irritable spirit was not the only cause of his silence. His mind seemed to have lost its elasticity, and besides, although he pursued his scientific studies to the last, he was becoming more and more occupied with family genealogies and his grievance against James Whatman for retaining the family heirlooms. This led to other historical investigations, the nature of which may be gathered from the final paragraph of the preface to the lectures on Evolution:

"Historical and ordinary anatomico-physiological researches have much in common in respect to method—the object of both being to ascertain facts and to trace out their concatenations and correlations. In lately editing for the Camden Society the Life and Times of my ancestral kinsman, brave old Bishop Bedell, of Kilmore—'Saint, Sage, and Hero' as he has been happily characterized by Mr. Gladstone, I followed, in a small way, the example of Niebuhr and Mommsen, inasmuch as I searched or had searches made in all directions, for original documents—wills, state papers, letters, and the seals thereto attached, parish registers, diocesan registers, tombstones, etc. In doing so, the aim was to obtain *authentic* information from *genuine* contemporary documents, in regard to the true reading of which there could be no doubt, and thereby to correct various current misconceptions. This, it is obvious, was merely the prompting of common sense and duty—although I believe that habits of scientific method in physiological and pathological researches may have materially aided the exercise [of] discrimination in my genealogical and historical inquiries."

The reader will not fail to notice the reason for dragging Irish history into an attack on Darwinism. It was to contrast his own way of going to work with that which he thought was adopted by many, if not most, scientific explorers.

The outcome of these historical researches was a learned volume on 'The Life and Death (during the Rebellion of 1641) of his ancestral cousin, Bishop Bedell, of Kilmore.' It was issued by the Camden Society in 1872. The curious will find the full and characteristic title below in a foot note.* A cousinship was claimed because the bishop's mother, Elizabeth Elliston, who died in 1641, was a far back ancestor of Jones's maternal grandmother. About a third of the book is a carefully edited reproduction of an extremely interesting old manuscript in the Bodleian, written probably by the eldest son of the bishop. This is followed by twenty chapters evidently representing a vast amount of genealogical research, to which are added three appendices which include two belated letters and a pedigree. This book is not merely an account of William Bedell and the direct and collateral branches of his family; it also includes a pretty wide survey of contemporary Irish history, well told and thoroughly readable. It is a period with which most of us are probably but slightly acquainted, but it has a special interest in the present distracted state of that country. We may, perhaps, glean from it this crumb of hope: that, as murder and other atrocities seem to be the normal expression of Irish discontent, they are likely to subside as they have so often done in the past. But as far as permanent peace is concerned such glances as this into the past are, it must be owned, by no means encouraging.

From this he passed to a more extensive study of Irish history and politics, which resulted in a small volume on "Rule in Ireland, from St. Patrick to Cromwell," published many years afterwards. In the advertisement it is stated: "The following pages are extracted from a work in manuscript entitled—'Story of the Irish Rebellion of 1641, and its correlations with the contemporary Troubles in England and Scotland,' on which the author has been for some years engaged. Ventnor, I.W."'†

It is a very concentrated piece of history; too full of facts related in quick succession to be interesting. There are a few, but not many, of Jones's own comments, from which it may be gathered that his sympathies were not all with Ireland as opposed to England. Thus he points out that Roman Catholicism was imposed upon Ireland by Henry II., but was not the original form of Christianity adopted by that country. This is, of course, no excuse for the harsh treatment of Irish Roman Catholics, but it

*A true Relation of the Life and Death of the Right Reverend Father in God, William Bedell, Lord Bishop of Kilmore in Ireland. Edited from a MS. in the Bodleian Library, Oxford, and amplified with genealogical and historical chapters, compiled from original sources, by the representative of the Bishop's mother's family of Elliston, Thomas Wharton Jones, F.R.S. Printed for the Camden Society, MDCCCLXXII.

† R. Medley, 38, High St., Ventnor, 1887, price 6d.

partly takes the sting out of one of the most cherished of Irish grievances. He also shows that some other Irish grievances are founded on complete misconceptions, and we learn without surprise that he himself was a staunch Unionist.

Unfortunately, historical studies, sometimes made vicariously, brought no grist to the mill. On the contrary, they ate into what little grist may have been on the way. Jones never had a large private practice, and, as I knew him, his antiquated manner and appearance were by no means calculated to attract patients or to inspire their confidence. What little there may have been therefore dwindled completely away, and as none of his books, except perhaps the "Manual," can ever have been a source of much income, his circumstances became more and more straitened, and by degrees he fell into absolute poverty. His circle of intimate acquaintances had never been large, and his somewhat caustic pen and habit of very free criticism had brought some of his earlier friendships to an untimely end. Few therefore knew of his miserable plight when the exceptionally severe winter of 1880-1881 set in. It was bitterly cold. There was a succession of blizzards and the snow lay deep in the streets, or was piled up into walls six feet high or carted into huge heaps in the squares, the traffic for seven days being almost at a standstill; when, one day Mr. Tweedy (as he then was) was asked at a meeting of the staff of the "Lancet" whether the biography of Wharton Jones was ready, as it was reported that he had written to University College to say that he was prevented from attending, presumably from illness, and it was thought that at his age—he was then 73—an obituary notice might soon be required. Tweedy accordingly went to the little house in George Street where, as has been said, Jones had given rooms to a poor couple—husband and wife—who looked after him in return for their lodging. "To his horror he found his old teacher crouched over a fireless grate, his shoulders hunched up under a mass of shawls and shabby wraps, the picture of destitution. He was gnawing an old and uninviting piece of beef steak and a crust of bread, the wretched meal being all, as the woman of the house declared, that she and her husband could spare from their own scanty food-supply."* He was, in fact, not only very ill but penniless and starving. Tweedy forthwith enlisted the sympathy of his colleagues Dr. Sidney Ringer and Mr. Erichsen and other leading medical and scientific men, and in a few hours had collected a sum of £140, which was paid into the bank in sovereigns so that Jones might not know to whom he was indebted for the money which literally saved his life, though his most pressing needs had been already quickly

*From notes supplied by Mr. Victor Plarr, Librarian of the Royal College of Surgeons.

supplied by the kind care of Mrs. Ringer, who had had much experience as a nurse.

About this time his piteous case was presented by Huxley and Sir Joseph Fayrer to Mr. Gladstone. The civil list of pensions was then made up, but the promise was given that Jones's name should head the next list, and he received from this source £150 a year from October 31, 1881, to November 7, 1891. He also obtained the Tancred Pension of £80 a year in June, 1881, at the instance of Sir William Jenner, who was then President of the Royal College of Physicians, which he enjoyed till the time of his death.

Assured of this moderate but perhaps adequate income, and recognizing that he was no longer fit for his work at the College and Hospital, Jones sent in his resignation and was granted the title of Emeritus Professor. He gave up his house in London and settled down at Ventnor in the Isle of Wight, where, after life's rather stormy voyage, he spent the evening of his days in a quiet haven. It was ten years before the obituary notice was needed.

Here he lived very quietly and evidently most economically, for he left a substantial sum (about £800) at his death.

Dr. Robert Robertson, of Ventnor, who was Resident Medical Officer at the Consumption Hospital in 1881, and who attended him on the rare occasions when he needed medical advice, draws a pleasant picture of the sage in his retirement, his few old cronies and his simple life, which may be quoted almost in full.

"No. 2, Swiss Cottages, where Wharton Jones lived while in Ventnor, and where he died, is one of a pair of small cottages of three stories in Belgrave Road facing south and looking out on the English Channel. As in many houses in the town, the cottages have their lower story below the level of the road. And here the tenant of the two cottages lived, working the two cottages as one house, and letting off the two upper stories as lodgings. Mr. Jones occupied the tiny south sitting room and small south bedroom of the westermost cottage. From its sunny and sheltered situation, and from its convenience of access to the main road of the town and of the undercliff, it was very suitable for an old man who found walking difficult.

On any bright morning in the 'eighties' a little old man with round shoulders, wearing a hard felt hat well off his forehead, with long grey hair down over the collar of a rather heavy overcoat which reached nearly to his heels, might have been seen walking slowly in the sunshine, with the help of a stick, along the footpath in Belgrave Road.

Eyes sunk under a large forehead, a Hibernian mouth and heavy chin, and the complexion of a chronic invalid, made one look at him a second time if one passed him on the road.

If you visited him in his lodgings in the winter, you would find

him buried in an easy chair beside the fire with the temperature of the room about 70° Fahr., his head covered with an old peaked cloth cap, an overcoat on, his knees protected by at least two old rugs, and his feet in Wellington boots.

'You are looking at my boots,' he said to me on one occasion, 'I did order a new pair twelve years ago, but I remembered that my brother had an attack of apoplexy the day he put on a new pair of boots, so I countermanded the order.'

It has been said that he was so afraid of taking cold that he would allow the sheets on his bed to be changed only twice a year. Judging of what I saw of his bedroom, I should say that that was probably untrue.

He lived very simply: 'Four ounces of lean beef steak daily, half at midday meal and half in the evening, with an ounce of chocolate after each meal, that is what I eat.'

He was not unsociable. While he was able to walk so far he used to visit his friend the Rev. Clement Hue at 'the Cottage,' St. Lawrence, about one and a half miles (Mr. Hue was, I believe, the son of a former physician at St. George's Hospital), and it was there I first met him at a garden party in the summer.

On one of Wharton Jones's visits to 'the Cottage' he noticed that an old tortoise in the garden was going blind, and at his request the tortoise was taken daily to 'Swiss Cottage' to be under Jones's care until it was cured. ['Mr. Jones carefully dropping drops into the eye of the creature in spite of vigorous and sometimes successful attempts to bite him.']

He visited also at 'Aherlow,' the residence of Dr. and Mrs. Shaw, less than half a mile away. Dr. Shaw, an assistant surgeon at the battle of Miani, Scinde, had then gone into the Mint at Madras before leaving India. [The chaplain of the Consumption Hospital, the Rev. J. A. Alloway, says he well remembers the three old men spoken of as Abraham, Isaac and Jacob—Wharton Jones, Hue, and Shaw—walking up and down in front of his house with arms linked, talking as they went.]

He had visits, too, from his old friend Mr. Commissioner Kerr, his residuary legatee, whose daughter lived in Ventnor and still lives here.

It is possible that he had other friends unknown to me. Acquaintance with those mentioned, indeed, implies that he might have known anyone that he cared to know. But he was easily fatigued, and could hardly face the effort of much social intercourse.

On one occasion I asked an old gentleman, who was senior secretary of the Archaeological Society of Oxford, to call on him, but as he was deaf they failed to interest each other.

To Mrs. Shaw, one of the kindest of women, he owed much. Up to the last she was always calling to see how he was; calling

on me to suggest that I should see him, if he did not seem so well, and not failing to ask his landlady if he had all he needed. She was herself old. She had spent thirty years in India. Her husband was in poor health. But she always found time to think of the 'Professor,' as she always called him.

In spite of his years, Wharton Jones was still fundamentally a tenderhearted, sentimental Celt [a Cymric Celt] of volcanic temperament. Tears still came readily into his eyes, and Mrs. Shaw was quite sure that there had been a disappointment in his early days, and that he had sacrificed his hopes to the needs of his relatives. His voice softened when he spoke of his brother, but became surprisingly emphatic when he spoke of scientific subjects. I was warned by Mr. Hue, when he proposed to introduce me to him, not to mention such matters, as he was apt to get somewhat hot in speaking of them, and long afterwards, when referring to text-books of physiology just published, he exploded. 'These physiologists they EXCOGITATE! They excogitate!' "

Dr. Robertson inherited, amongst other things, Jones's microscopes, one of which he has presented to the Royal Society of Medicine. It is a quaint little instrument, packed in a flat mahogany box $5\frac{1}{2}$ inches long by $4\frac{1}{2}$ inches broad. The stem screws into the middle of the box-lid. It has only one power. It has evidently been much used. The other was a good microscope of English make with movable stage, two eye-pieces and three objectives ($\frac{1}{4}$-inch, $\frac{1}{8}$-inch and $\frac{1}{10}$-inch), so he was as well equipped for his investigations as most of his contemporaries.

One wonders whether he had out his microscopes to verify his old observations or whether it was only in fancy that he "fought all his battles o'er again." Certainly he was not idle. His historical studies alone must have kept him busy and yet he found time to send no less than eleven communications to the "Lancet" between 1883 and 1889.

Their titles show how his mind was working; their substance that he was still alive to what was going on in the medical world, and more than sceptical about the methods and the accuracy of the "Professors" of the day. The list is not long and shall be given in full.

1883. "Observations on death from obstruction of the circulation through the lungs occasioned by Fibrinous Clots in the Pulmonary Artery."

1884. "Alleged emigration of white blood corpuscles from the interior of small vessels by boring through their walls." In this he expresses complete disbelief in the accuracy of Cohnheim's discovery; and says that what two Professors shewed him was not emigration at all, but something which he had himself seen and described long before.

1884. "Dilation of the calibre of small arteries."
1885. "Remarks on the circulation of the blood."
1885. "On the ova of mammifera before and after Fecundation."
1885. "Mechanism of the action of the Heart."

In the same year he began a series of polemical papers which in characteristic fashion restate his confidence in the accuracy of his own work and hurl defiance at his opponents.

1885. "Proceedings calculated to impede the progress of scientific knowledge of facts in Nature."
1886. "The Darwinian working hypothesis examined physiologically."
1886. "Peroration to my reminiscences of fifty years' struggle in the footsteps of William Harvey to search out crucial facts in physiology."
1887. "The white corpuscle of the Blood. A supplement to my remonstrance addressed to Professors of Physiology against teaching in their writings, lectures, or occasional orations that white corpuscles of the blood emigrate from the interior of small vessels until they have verified it by actual observation of their own as a fact in Nature."

And finally, in 1889, "On the state of the circulation in the extreme vessels in atropine and cocaine poisoning." This was a supplement to his paper of July, 1885, and explains by references to his old work the appearances which had been reported as being present in atropine and cocaine poisoning. Amongst other things, he says that atropine does not dilate the pupil of a bird because birds have no *dilatator iridis*. The paper also contains his last word on the emigration of the white corpuscles, and it is characteristic of the man that he never swerved from the position he took up with regard to Cohnheim's discovery.

But this was not the end of his literary labours. In 1891, the year of his death, he published a Report* (already referred to at page 107) which recapitulates, in the course of about seventy pages, all his work on the circulation, and all his opinions about the work of others in this field. Those who have not the opportunity to read his earlier writings may with advantage study this report, only they must bear in mind the circumstances in which it was written, the age of the author and some points in his character which I have tried to make clear. There is no need to describe it here in detail, but the "advertisement" shall be quoted to show the frame of mind in which it was written. "The following pages are respectfully addressed to the General Council of Medical

* "*Report on the state of the blood and the blood-vessels in inflammation*, and on other points relating to the circulation in the extreme vessels: together with a report on lymphatic hearts and on the propulsion of lymph from them, through a proper duct, into their respective veins." London: Baillière, Tindall, and Cox. 1891.

Education—Universities and their Colleges—Colleges of Physicians, Colleges of Surgeons, and all other Authorities, who may consider the faithful instruction of Students of Medicine in a real knowledge of the phenomena of the Circulation of the Blood to be of paramount importance." Not yet—he seems to say—do I see any sign of the Professors coming round to my views; but yet he does not despair, for on the title page we read these strange but hopeful verses:

"In yonder world, I do believe,
That Truth they still maintain;
But with the lies that here prevail,
Our Marshal fights in vain."

—*Bismarck.*

"Sham fails,
Truth prevails."

—*Moltke.*

He passed away, full of years, without any definite illness on Nov. 28, 1891, waving his standard almost to the last. I think it was the fighting spirit that deprived him of the meed of praise that was certainly his due. The mischief of most scientific contests is that they are waged not against a common foe but are disputes amongst allies as to the best method of advance. Jones was too apt, not only to maintain his own view with fervour, but to disparage overmuch the opinions of others, and when it was all settled, to complain that the soundness of his views was either grudgingly recognized or not recognized at all. Often, no doubt, the complaint was justified, but this was not the way to conciliate rivals or to cement friendships.

He lived so long after the close of his active career that few of his fellow workers survived him, and his departure was scarcely observed. We have referred to Sir John Tweedy's excellent obituary notice in the "Lancet," but his name does not appear in the Dictionary of National Biography—it was one of the overlooked, *caruit quia vate sacro.* And now it seems strange that this belated memoir should appear in an Ophthalmological Journal, because, though he was a great ophthalmologist, it is really as a physiologist that his name should go down to posterity. But how few there are, even amongst the most brilliant cultivators of this shifting science, whose names will be remembered. Their records are written on the seashore, and only a few beyond the wash of the tides. So small a proportion of "physiological facts" are permanent, and these are so soon overshadowed by exciting new discoveries, that their discoverers are often forgotten. It is hoped that these pages may help to recall the fact that Wharton Jones's name is not the least worthy amongst this noble band of pioneers.

His private life, as far as we know anything about it, presents a somewhat low-toned picture. He seems to have missed, by so little, much that might have made him happy and successful. But this

little made all the difference. Doubtless, when absorbed in scientific work, his troubles were, for a time, forgotten; doubtless in early middle age, when his reputation was European, he enjoyed the appreciation of his teaching and the prospect of a brighter future than that which was in store for him; doubtless, also, his polemics were not altogether distasteful to him; but, when all is said, it is impossible to believe that, on the whole, he had more than a very moderate share of happiness or even of contentment.

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COMMUNICATIONS

SCOTOMETRY*

BY B. T. LANG,
LONDON.

WHEN I was asked to read a paper on Scotometry, I began to ask myself what were the limits of the subject, and how it differed from perimetry. In scotometry one is concerned with scotomata, that is, more or less blind areas surrounded by more or less healthy, seeing, retina. The term is applied, I believe, by common consent, to the investigations of those areas near the fixation point, within 30° to 40° of it.

It differs from perimetry in no respect other than that it involves a more detailed investigation.

Two types of scotoma are recognized—absolute, when an area of the retina is quite inappreciative of all light, and relative, when, although it can appreciate brightly illuminated white objects, it is inappreciative of certain colours or grey, or even, on occasion, of white objects if the illumination be sufficiently reduced.

In determining the size of a scotoma, various points have to be considered. These are:

1. Illumination.
2. Colour of the object.
3. Colour of the background.
4. Size of the object.
5. Rate of movement of the object.
6. Distance of the object.
7. Scale and size of the chart.
8. Method of making the observations.
9. Influence of the patient's refractive error.

1. *The intensity and colour of the illumination are important.* One desires to find out if any part of the retina is even only partially insensitive to light. If quite a small object be very brilliantly illuminated it may be quite possible for it to be seen over an area in which a much larger, but poorly illuminated, object may be invisible. The light should not therefore be too intense. Direct bright sunlight should be avoided. Indirect sunlight and daylight vary in intensity from day to day, and in colour from season to season.

Thus a scotoma might be found to vary from time to time with varying intensity and colour of light when in reality, it is of unaltering size if examined under strictly comparable conditions.

No standard of artificial illumination has yet been agreed upon,

* Paper read before the Section of Ophthalmology, Roy. Soc. Med., February meeting, 1921.

but the light from a single carbon filament lamp, such as is used in ophthalmoscopic examinations, half a metre from the object is found to be fairly satisfactory as long as the lamp is new.

The great disadvantage of all forms of carbon filament lamp, however, is that they alter rapidly both in colour and intensity after only a few hundred hours of burning.

Recently two lamps standardized as to colour have appeared on the market. I refer to the Sheringham Daylight Lamp and the Chance Daylight Glass. They both employ gas-filled (so-called "half-watt") lamps, and by correcting this light each produces what is substantially daylight. The difficulty in employing either will be in keeping the light intensity sufficiently low. One probably does not require more than 20 to 30 candle-power, and it may possibly be necessary until smaller gas-filled lamps are made, to place the lamps at some considerable distance from the object or to employ small white surfaces to reflect only a portion of the light.

2. *The colour of the object is important.* Green is less easily seen than red, and red than blue, and blue than white.

Green may appear to change colour into yellow or grey, and thereby demonstrate, even when using a comparatively large object, a change in retinal sensitiveness which, had white been employed, could only be discovered by using quite a small object and then only if in a dull light, and possibly not even then. When using a red object, the intelligent patient may observe that the intensity of the colour itself may vary in different parts of the field, even though the object itself does not become invisible.

3. *Background.* There should be a marked contrast between the colour of the object and the background. This may conveniently be black or grey. It should not reflect any light.

Some surgeons use a white background and a black object. This method works admirably for plotting out the blind spot, but difficulties arise as soon as attempts are made to determine the size of a relative scotoma. A green object, invisible on a black background, becomes a black object on the white background. Further, the handle on which the object is mounted, unless exquisitely white, is very obvious against the background and may throw a shadow. Complications arise in dealing with a relative scotoma, in that the retina may become partially fatigued and the result obtained may not be comparable with that found when a black background is used.

4. The *size of the object* should be measured in terms of the angle that it subtends and not by the length of its edge, otherwise a comparison of the results obtained by different observers working at different distances is difficult.

Some observers state that half a degree should be the smallest size used. If one only uses this large size and does not also go

over the field with a coloured object, one will almost certainly fail to find a small scotoma. The object in an Elliot scotometer subtends about an eighth of a degree and is certainly not too small.

5. *Rate of movement of the object.* This is a matter of utmost importance—of a great deal more importance than is usually accorded to it. If the surgeon is anxious to discover areas that are possibly only slightly less sensitive to light, the patient must be given time to consider and make up his mind as to whether the object does change in appearance or colour.

If, when employing similarly coloured objects subtending the same angle, different results are obtained when working at different distances, as for example with a Bjerrum screen at two metres and a perimeter at 33 cm., the principal, if not the only, reason for the discrepancy is the difference in the speed with which the object is moved in the two cases. It will be noticed that most surgeons move the object when working with a Bjerrum screen at two metres not more than 4 to 8 cm. a second, that is 1° to 2° a second. In order to obtain comparable results when working with a perimeter, it is essential that the image of the object should pass across the retina at substantially the same speed. This means that the object should be moved at not more than one-sixth of the speed; that is, about 1 cm. per second along the perimeter arm. In order to attain this, the handle of the ordinary McHardy perimeter requires to be turned at about the same rate as the second hand of a watch. It will be admitted that it is rare for this precaution to be taken, and that usually when attempts are made to plot out a scotoma with a perimeter, the process is a less leisurely one than when a Bjerrum screen is employed.

No standards of speed have been established. But they should be. The statement that no scotoma is present should always be qualified by giving the size and colour of the object employed and the approximate speed at which it was moved.

6. The *distance* at which the observations are best made is a most controversial topic. Some aver that the nearer the object is to the patient's eye the better. Others consider that it is only by working at two metres or more that really accurate observations are made.

Subject to the conditions under which the observations are made being comparable, it is quite unimportant at what distance the object is from the patient, always excepting that it should not be too near. It is probable that if it be nearer than 33 cm. it is disadvantageous. The object is of necessity small and it is obvious that the patient should have a clear sharp image of it on his retina. He should therefore wear glasses to correct any refractive error he may have, with a suitable addition if he be presbyopic. Many of these patients are presbyopic and their reading glasses will not enable them to

read at a distance nearer than 33 cm. It is difficult to get a patient to keep a trial frame and lens in place while taking out a scotoma, and therefore difficult to correct for an object nearer than his reading distance. For these reasons it is undesirable to work nearer than 33 cm.

Not infrequently it will happen that one requires to take out the scotoma of a patient with a central scotoma. Then he will be instructed to place the tip of his index finger on the fixation spot and to look where the tip of his finger is (not to look at the tip of his finger, or he will look at it eccentrically and the result obtained will be valueless). Under these circumstances the central fixation point must be within reach and therefore should not be more than half a metre away at the most.

All the earliest work was done at two metres or so. I believe that the original findings were only possible when working at such a distance because observations were made in daylight with white objects and that it was only by working at this great range and with minute objects that the intensity of the stimulus was sufficiently reduced to enable the small changes of sensitiveness of the retina to be discovered.

With suitable appliances and appropriate conditions, quite as accurate observations may be made at the usual perimeter distance of a third of a metre.

7. The *scale and the size of the scotometer chart* are purely matters of convenience. It is desirable that one degree of arc should be represented by at least as much as two, probably 3 millimetres. If a smaller scale than this be used variations in the size of the blind spot, for example, may not easily be noticed. The chart should be big enough to include the fixation point and a part of the 30° circle.

8. *Methods.* There are many methods. A good method should

1. Be easy to employ,
2. Give accurate results,
3. Enable a permanent record to be made easily,
4. And above all, enable the observer to watch the patient, if necessary, the whole time to see if he is keeping his eye fixed on the target. Most patients will allow their eye to wander unless they are carefully watched.

When using Bjerrum's screen, one works two metres or so from the patient. One must watch where one is moving the object. One cannot therefore pay that attention to the patient that is usually necessary. Pins may be put into the screen to mark out the limits of the scotoma, and the position of these may be plotted out on to a suitable chart afterwards. The method is extremely accurate, but far from rapid. It requires the services of two persons,

one to move the object and one to watch the patient. It is not self recording.

A considerable improvement has recently been introduced, and consists in attaching the object to one limb of a pantograph. This is used to reduce the size of the scotoma suitably, and by means of a pricker, a permanent record is made on a chart that is mounted near the edge of the screen. The observer can now face the patient and watch his movements but from a distance of two metres it is difficult to be sure that he is keeping his eye fixed on the target.

Elliot's scotometer is designed to be used at the distance of one metre. With it eventual plotting out of the scotoma is more rapid than in the case of a Bjerrum screen in that a numerical value is obtained for the position of the margins of the scotoma. It is more easily used if one has an assistant to copy down the numbers so found. By standing at one side one may obtain a tolerably good view of the patient's eye to see if he is keeping his attention fixed.

Accurate results may be obtained by using an ordinary perimeter. There are two objections to this method.

The first is that the small object is usually mounted on a large object holder. It is difficult then to determine whether the patient sees the object or the holder. If a suitable object holder be employed the only objection to taking the field on the perimeter is the fact that the reduction is too great. In the McHardy of the usual type the 180° is represented on the chart by 100mm, which means that the whole of the scotometer chart, that is up to the 30° circle, would only be the size of a penny, which is obviously far too small.

A perimeter fitted with a two-scale reduction device would be excellent but the charts must be made of such form that it would be impossible to use the wrong one. Some of the original recording perimeters had such a two-scale reduction device but they went out of use because the difference between the two scales was insufficiently great to avoid the possibility of mistakes, and one was at times in doubt as to whether the low or high gear had been employed more particularly, since for the sake of simplicity, they only employed one chart for both purposes.

If the difference in the scales be great, say as much as 6 to 1, this confusion could not occur.

With such a perimeter when the scotometer gear was being used the driving mechanism would also be altered so that the speed of the object would appropriately slow.

When using a perimeter it is easy to watch the patient.

More recently other forms of instrument have come into use. They are simpler and therefore less expensive than a perimeter. During the war, Dr. Gordon Holmes used a screen of the Bjerrum type but worked nearer the patient. He employed an object holder

which had a pin protruding backwards. With this a prick is made through the cloth on to a piece of paper placed immediately underneath. By this means one has a full sized record. Mr. Bishop Harman employs a grey screen at a third of a metre. Under this he has a piece of carbon paper and a chart. He uses a rigid object holder with a style-like process passing backwards. He marks the limits of the scotoma by pressing the holder backwards thereby obtaining a permanent carbon record.

In neither of these methods can one see the exact limits of the scotoma until one lifts off the screen. It not infrequently happens that when one is working out the limits of a crescentic or irregular scotoma, one wants to know if one has left any part of the margin incompletely defined. For this reason the perimeter type of scotometer would be particularly useful.

For this reason I designed a new form of scotometer. It has no advantage over a good perimeter, except that it is cheaper. One can watch the patient, one can observe where one has determined the limits and where one has not, and any piece of paper is suitable for making the record on. It is not necessary to employ a particular form of chart.

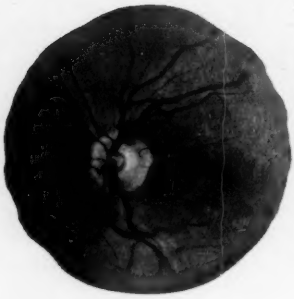
9. When one is considering the size of the blind spot and comparing it with the normal, it is essential to remember that the refractive error will have a profound influence. In high myopia, for instance, the angle between the limits of the blind spot and the centre of the pupil will be a much smaller one than in the case of a high hypermetrope. In fact the disc of the latter throws a scotoma about twice the diameter of the former. This will account, I think, for the remarks of one observer at the Oxford Congress last year, who found that the size of the disc plus the myopic crescent was not much, if any, larger than the normal scotoma for the emmetropic disc.

Some extremely important observations may be made with a scotometer. It occasionally happens that a patient with a high degree of hypermetropia may possibly be the subject of increased intracranial pressure. The question then arises, is the swelling of the disc physiological or pathological. If the size of the disc when determined with a dull green is only slightly larger than with a brilliant white, the condition is probably physiological. If the scotoma for green be considerably larger, then the nutrition of the retina around the disc is disturbed, and the condition is probably pathological. The scotoma for colour is usually slightly larger than that for white.

In obscure nervous diseases with slight disturbance of visual acuity but no change visible in the retina, and no central scotoma, the blind spot may be enlarged for red or green.

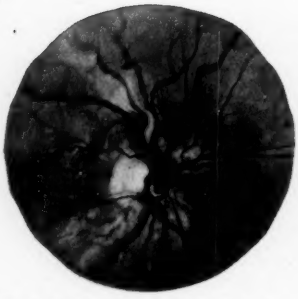
In certain cases of toxic amblyopia and in cases of retrobulbar

PHOTOGRAPHS OF FUNDUS TAKEN WITH PROF. SALOMONSON'S APPARATUS.

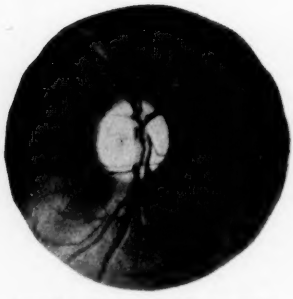


Normal fundus.

Choked disk in cerebral tumour.



Choked disk in syphilitic meningitis.



Atrophy of the papilla n. optic in sclerosis multiplex.

neuritis, scotomata for red and green or for green only may be found. At times the green is seen the whole time but is stated to change colour, turning to yellow.

Occasionally a paracentral scotoma may be found. Rarely, in cases of pituitary tumour, a small central scotoma strictly limited by the mid line, usually bi-temporal, may be present.

But of course the purpose for which scotometry is of such importance is the determining of the increase of the blind spot in cases of suspected glaucoma.

A NEW PHOTOGRAPHIC AND A NEW DEMONSTRATION OPHTHALMOSCOPE*

BY

PROFESSOR J. K. A. WERTHEIM SALOMONSON,

AMSTERDAM.

IN both these instruments, Gullstrand's principle of the "simplified indirect reflexionless ophthalmoscopy" has been applied (v. Tigerstedt, *Handbuch der physiologischen Methodik*, Vol. III, i; *Sinnesphysiologie*, Vol. III, p. 88, 1814). We shall first consider the photographic instrument.

Fig. 1 shows the general arrangement of the illuminating and the reproducing optical systems. The ophthalmoscope A lens forms a part of both systems. It is one of Zeiss's aspheric aplanatic lenses. The image of the retina formed by this lens in its back focus *a*, *b*, is in the photographic instrument reproduced on the same scale by means of a photographic lens B. The illuminating agent is a small arc lamp K running on some 6 amperes. A condenser C forms an enlarged image of the crater on a diaphragm D of 8 millimetres diameter. A rectangular prism E placed immediately below it deflects the illuminating rays in the direction of the ophthalmoscope lens, the surface of which is reproduced in the plane of the condenser by a lens, resting on the diaphragm, where also the photographic shutter has been placed. The already-mentioned reflecting prism partly covers the front surface of the photographic lens, so as to leave a free surface of a little more than half the diameter of the last one. If the pupil of the eye be placed at such a distance from the ophthalmoscope lens that this reproduces the aperture of the photographic lens, and, of course, also the illuminated diaphragm in the pupil of the eye, we have fulfilled the condition postulated by Gullstrand for the elimination

*Based upon a demonstration given before the Section of Ophthalmology, Roy. Soc. Med., on January 14, 1921.

of the reflexes on the cornea and the eye-lens; provided that in the eye pupil there be a free space of nearly 2 millimetres between the image of the diaphragm and of the uncovered part of the photographic lens.

We now have still to consider the presence of two images *r* and *s* of the illuminated diaphragm formed by reflection on the front and back surface of the ophthalmoscope lens. These images have a great instrinsic luminosity, and would spoil the photographic reproduction of the retina; therefore they must be rendered innocuous. In my instrument this is done by placing two very small blackened screens, of about 1·5 millimetre diameter, exactly in the places *r*, and *s*, when these reflexions are sharply reproduced by the photographic lens. As these screens cause the appearance of a limited quantity of diffracted rays behind them, I had also to

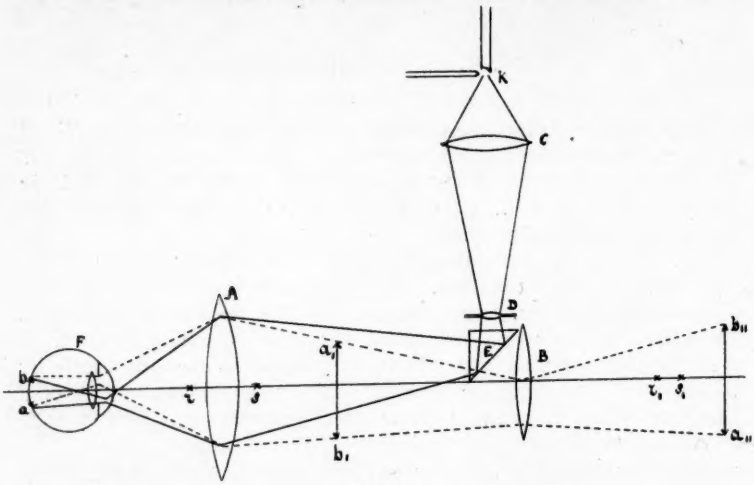


FIG. 1.

reduce the photographic action of the reflected rays by the interposition of a very small yellow transparent screen on the centre of the surface of the condenser. The illumination of the fundus is not appreciably lessened by this screen, whilst the reflexions on the ophthalmoscope lens are practically eliminated.

During the focussing of the retinal image the intensity of the arc light is reduced by a suitable absorbing medium, viz., a smoked and varnished mica-plate. Exposures of about 1/10th to 1/12th second are sufficient to give excellent negatives on panchromatic plates. They easily bear a direct enlargement of about two times. Having a diameter of 40 millimetres, they show the fundus over a solid angle of 30° covering a little more than five times the diameter of

the papilla nervi optici. For taking photographs the pupil ought to be dilated to at least 7 millimetres.

The aspheric aplanatic ophthalmoscope lens has a focal distance of 70 millimetres, a diameter of 50 millimetres. The photographic lens is a tessar by *Zeiss* of 15 centimetres focal distance working at f. : 4.5. The distance of the instrument from the eye is about 80 millimetres.

In the demonstration instrument, which is much smaller than the photographic instrument, I use a small $\frac{1}{2}$-watt lamp absorbing about 10 watts instead of the arc lamp. Instead of the photographic lens and camera a small short telescope is employed for viewing the image of the retina. In order to eliminate the reflexions on the ophthalmoscope lens, the light from the lamp passes through a small achromatic double-refracting prism ; a very narrow slit which serves as a diaphragm allows only the rays of one of the two images of the glowing filament to pass through it. These rays are polarized, and the reflected images of the diaphragm consist of polarized light. In the fundus the light is depolarized. As the telescope contains a small Nicol prism the reflexions can be extinguished, whereas the retinal image remains visible. The magnification of the telescope can be varied by using different eye pieces. The absolute magnification of the retina can in this way be varied from 6 times to about 50 times. Generally a magnification of 14 times is used, giving nearly the same magnification as with direct ophthalmoscopy, but with a field of vision as in indirect ophthalmoscopy. The field is a little less extensive than with the photographic instrument, and covers nearly 28°. Of course with the strongest eyepieces the field is much narrower, and with the strongest eyepiece we can just cover the papilla nervi optici. The light is quite sufficient even with this strong magnification ; it is about 10 times stronger than with the large Gullstrand ophthalmoscope, so as to render the use of strong eyepieces of practical advantage.

The greatest advantage of the instrument is that we are able to place it before the patient so as to render the image of the retina immediately visible to anyone looking into the instrument, even if he has not the slightest notion of ophthalmoscopy. The image needs only focussing, which is done by a slight movement of the eyepiece. I use the instrument regularly in my clinical lessons, and during my lectures, in order to show the retina to my students. Those who are not yet able to use the ordinary ophthalmoscopes can see the retina ; those who can use them see it much better with my instrument than with the ordinary ophthalmoscopes.

AN IMPROVED PERIMETER AND SCREEN FOR EXAMINING THE FIELD OF VISION

BY

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THE improvements I propose to introduce in the construction and the use of the perimeter or the Bjerrum screen, seem to be of such nature as to diminish greatly the apparent limitations

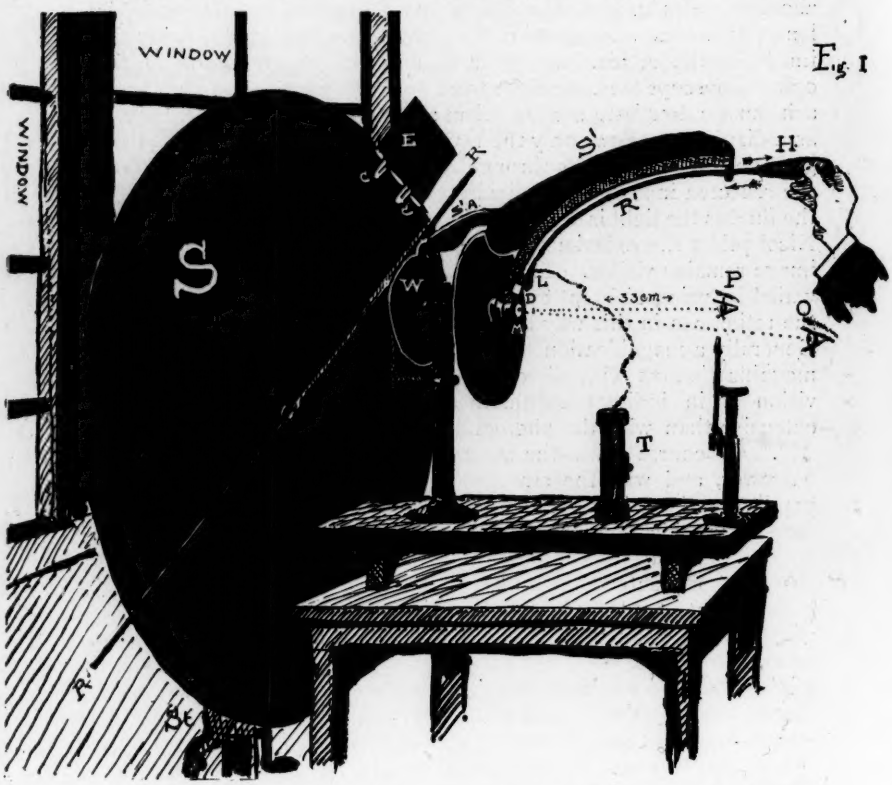


Fig. 1

which were so far unavoidably attached to the use of the two above-mentioned instruments in their present state of construction. The three drawings given in Figs. 1, 2, 3 speak for themselves, and require only few additional explanations. Fig. 1 illustrates a perimetric examination with the aid of a Priestley Smith perimeter. To this latter instrument I added an additional broader background,

represented by the meridionally-curved screen S', a black flap. S' is fixed by a bent blackened side-arm (S'A) to the disc W, while the other end of S' is tied to the foremost end of the graduated perimeter arc. W, S'A, and S' rotate conjointly with the perimeter arc when measuring the spherical field of vision. In the centre of the perimeter is placed the mirror (M), which, to my mind, constitutes the most essential and pre-eminent part of the improvements here introduced. For this reason I may be allowed to

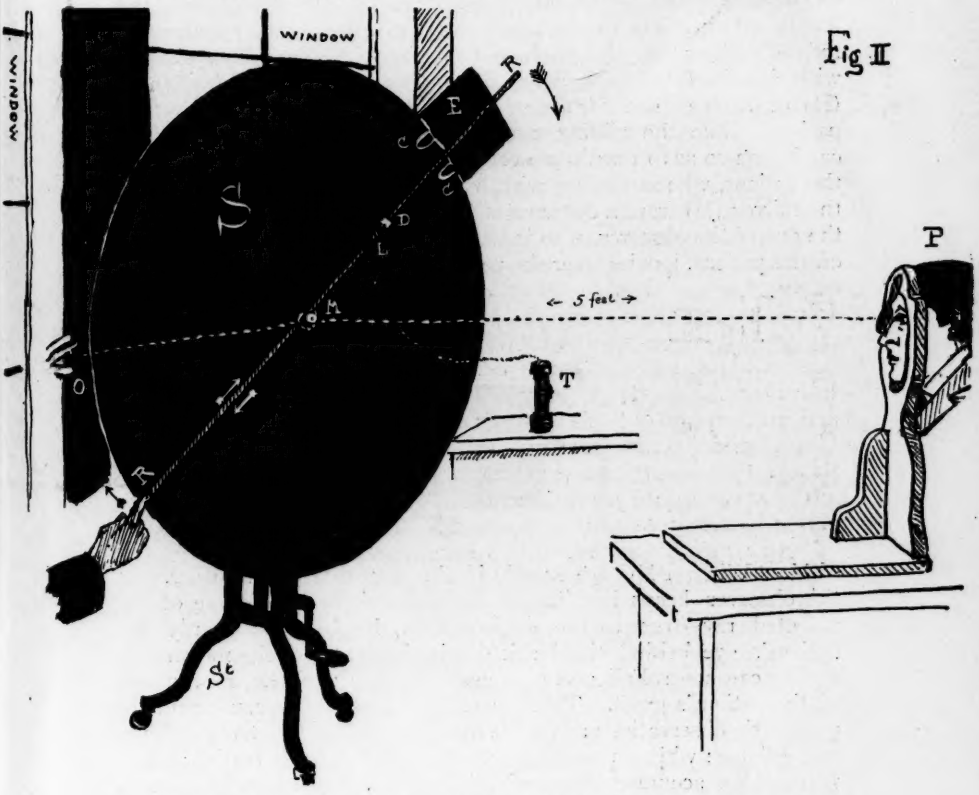
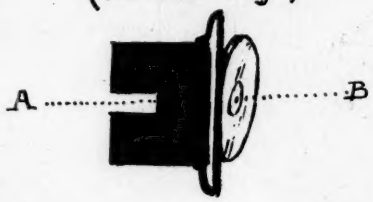


Fig II

explain at somewhat greater length the particular working of this mirror (M). Fig. II gives the mirror in its actual size, i.e., a round plane reflecting mirror, fitted into the one end of a short hollow metal tube working on the identical principle as the small (concave) mirror in Morton's ophthalmoscope. The mirror tube is slipped over the front end of the solid fixed axis of the perimeter when bringing M into its right working position, as shown in Fig. 1. The

centre of the mirror (M) is covered by a white round spot (2½ millimetres diameter in size) with a 1½ millimetre black dot in its middle, these two marks constituting the fixed object to be fixed by the patient. The movable mark D (Fig. 1) a white disc, is fixed together with the illuminating minute electric lamp L—(L being enclosed in a small blackened metal encasement)—to the inner end of the rod (R'). The outer end of the rod (R') passes through the opening of a metal ring—(this ring being fixed to the outer end of the perimeter arc)—terminating in the handle (H). By pushing the handle (H) inwards and pulling it outwards, the observer makes the rod (R') glide along the graduated arc conjointly and consensually with the disc (D) and the lamp (L). The movement of the handle (H) or of the hand of the observer remain unobserved by the patient, while the gliding movement of R' along the arc can be carried on so as to remain almost entirely inaudible. P., the eye of the patient, who is resting with his chin on the chin rest, is fixing the mirror (M) from a distance of 33 cm., while O is the position of the eye of the observer, who is sitting behind, and slightly sideways of, the patient, looking over the patient's shoulder towards the centre

Fig III (ACTUAL SIZE)



of M. When PMO are exactly in the same horizontal plane, and the observer keeps his line of fixation strictly to the line of the reflected ray (true to the angle PMO), he can see exactly the patient's eye behind the black dot in the centre of the mirror (M) and he can control all and any, even the very slightest, movements of the patient's pupil. Thus, to my mind, all the measurements in perimetric observations are made to a very high degree true, definite, and reliable; while the ordinary method of direct observation, fixing more or less accurately the patient's eye, is bound to lead to greater or lesser errors of calculation. My method naturally finds its limitation where the patient's vision is so defective that he cannot fix at all the centre of the mirror. Accordingly, as the observer examines the right or the left hemisphere of the field of vision, he should take his position alternately behind the patient's right or left shoulder, and the observer should at the same time turn the (oblique standing) mirror M (cf. Fig. 3.) round the axis AB by an

angle of 180°. Fig. 1 shows how the perimeter observation is made by the additional aid of a large Bjerrum screen (S) placed at the same time behind the perimeter and in front of two windows, hereby allowing only light coming chiefly sideways from right and left on the patient's eye. P is thus strongly illuminated and shining up brilliantly in the mirror against the large black ground of S.

Fig. II illustrates the observation made with the screen (S) alone. The radius of S is only 2 feet (so as to make the screen less bulky), and there is an additional ($\frac{3}{4}$ ft. size) screen extension (E), easily to be attached by two black clips (CC) to the outer ring circumference of the screen (S), protruding along the line of the meridian, along which the measurement just happens to be carried out by the rod. The screen (S) is fixed to the top of an adjustable ophthalmic table (ST), so that S remains in a fixed position, in which it cannot be turned. In front of the plane of (S) protrudes slightly the screen-axis (as shown in Fig. 1) in the shape of a hollow metal tube perforated transversely by two small round openings, which just allow the black (graduated) rod (R) to pass through in a gliding radial movement and to rotate also round the screen-axis (as shown by arrows in Fig. II). A thick cork (of about $1\frac{1}{4}$ inch length) is fitted to half its length into the front opening of the screen axis tube, when by pressing the cork tighter and deeper into the tube towards the passing rod, the latter can be arrested hereby in any position. Over the protruding end of the cork is then slipped the tube end of the mirror (M), which latter is then fixed in this position (cf. Fig. II) to be handled and used in the same way as described in the perimeter examination. The observer stands in this case in front of the screen, slightly to the right or left of the centre of S with his back to the patient, watching all the time the patient's eye as reflected in the mirror (M) in the direction of OM. The observer is then shifting with his one hand radially and by a rotating movement the one end of the rod (R) and conjointly and consensually with it at the same time also the disc (D) and the lamp and lampholder (L) These three objects being jointly fixed to the rod (R). The other disengaged hand of the observer manipulates the switch of the electric torch (T), which is to be carried, for greater convenience, in the observer's breast pocket during the perimetric as well as the screen observation. If absolute darkness of the room be preferred for the observation, instead of the daylight illumination, one should post a small electric lamp to the right or left side at the back of the screen (S), allowing only a narrow pencil of light passing from the lamp in the direction of the patient's eye.

The improvements above suggested may be readily adapted to Elliot's scotometer.

A RECORDING SCOTOMETER*

BY

E. O. MARKS, B.A., M.D., T.C.D.,

BRISBANE.

THERE appears to be a general agreement that the black screen of Bjerrum affords the most accurate, though laborious, method of detecting and mapping out the finer defects in the central and paracentral portions of the visual field. The ordinary perimeter is not sufficiently delicate in its action for such purposes, though invaluable in dealing with gross defects, especially if these are situated towards the periphery of the field where the use of a plane surface is impracticable or impossible.

The perimeter has, in addition to its smaller size, the very great advantage that it is capable of automatically recording its results on a chart. The importance of the saving of fatigue to the patient, and of time and labour to the surgeon, by such an automatic device as the McHardy perimeter, needs no emphasis.

The desire to combine the advantages of the two methods has given rise to several modifications of the Bjerrum screen with which the writer is acquainted. There are probably many to which he has not found reference in the literature at his disposal. So far as he is aware, the device now put forward has not previously been utilized. None of the instruments in use appear to be entirely automatic—either concentric circles or meridians, or both, requiring to be read off and marked on the chart, or noted, and later plotted on the chart. Moreover, the instruments all work in circles or meridians, a feature which usually shows itself in the peculiar outlines of the scotomata as charted, and is a handicap in following the outline of a scotoma when under investigation.

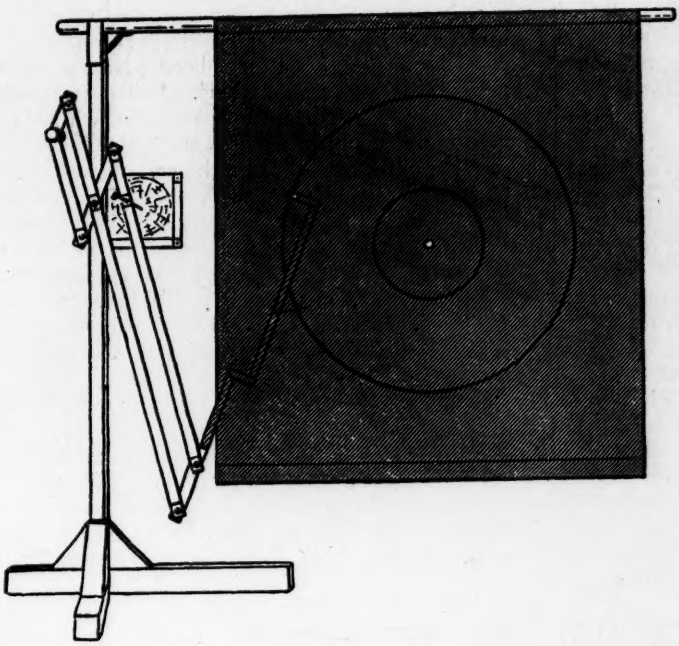
The present instrument, which is really a recording attachment for a Bjerrum screen, has been designed to obviate these defects by providing a test object which moves freely about the field in any direction, in a manner entirely regardless of circles or meridians, while at the same time providing a means of automatically recording on a chart the position of the test object in reference to the fixation point.

It has been constructed to a scale to suit the ordinary Bjerrum curtain, and at a working distance of one metre can record to beyond the 30° circle on a chart 8 inches square. By using charts drawn to corresponding scales, the same instrument could if desired be used for other working distances. It has been designed for a curtain 15 metres square, but the same device could be utilized for smaller or larger instruments.

* Read at the 11th Australasian Medical Congress, Brisbane.

The mechanical principle adopted is that familiar to engineering draughtsmen in the reducing instrument known as the pantograph. It is both simple and mathematically exact in theory. Any error that occurs must be due to faulty construction or use, or to that predominant factor in any subjective examination—the patient.

The instrument consists of a suitable base, from which springs a vertical standard to a height of 6 feet. Supported by a bracket and round hole in the top of the standard, a rod projects horizontally 6 feet, and has attached to it the black velveteen curtain. By



pushing the rod horizontally through the hole in the standard, or by twisting it in the manner of a roller blind, the position of the curtain (and fixation object) may be adjusted to the rest of the instrument. Attached to the standard, 4 feet from the floor and on the same side as the curtain, a board holds the chart by means of suitable slots into which the chart is slipped into position.

The moving part of the instrument is suspended on a pivot attached to the standard on a level with the chart. It consists of two jointed parallelograms and a pointer. The larger parallelogram and pointer (which is continuous with a short side of the parallelo-

gram) form the essential portion of the instrument, the smaller parallelogram serving merely to carry a balance weight. They are constructed of thin wooden laths, the bearings and pencil holder being of metal. The dimensions, which have been adopted merely for the sake of obtaining a suitable range of movement and magnitude of chart, give a reduction of 7 to 1 and are

Long side of parallelogram	...	3 feet 6 inches	Between centres
Short side „ „	...	6 inches	
Pointer, from test object to near bearing	...	3 feet	
Pencil, from bearing	...	6 inches	

The pointer, if a simple straight one, would in some positions obscure the fixation point. To obviate this it has been given a double elbow and is capable of turning on its long axis. It is covered with the same black velveteen as the curtain and provided with a test object on each side. The test objects, white and coloured, are on black velveteen covering a clip which slips on the end of the pointer.

The pencil holder is merely a short tube, through which the pencil may be pressed against the chart whenever it is desired to record the position of the test object.

In the board supporting the chart is a small hole corresponding to the position of the centre of the chart. This takes the wire centre of a "dummy" pencil, and serves to hold the instrument in the central position while the curtain is adjusted so that the fixation point and test object coincide.

The whole instrument might conveniently be arranged as a wall fixing and provided with electric illumination.

The chart has been printed to show (on tangent scale) the concentric circles at 5° intervals up to 30° and meridians at 30° intervals. On the curtain the 10° and 25° circles have been marked in black silk, in deference to Priestley Smith's opinion of their diagnostic importance, and to act as a check on the accuracy of the instrument.

A POINT IN FAVOUR OF PROFESSOR ARTHUR THOMSON'S THEORY OF THE PRODUCTION OF GLAUCOMA

BY

JADAVJI HANSRAJ VAIDYA, D.O.M.S.,

INDIA.

IT is a common observation, which I have often confirmed, that an attack of acute glaucoma comes on between midnight and early morning, i.e., after a few hours sound sleep. The history is to the

effect that the patient went to bed as usual without the least premonition of an attack of one of the most painful diseases he or she has ever experienced.

By questioning the patient we can elicit some information as to previous state of health. The history may be absolutely without medical interest. Some prodromata of glaucoma, on the other hand, may have been experienced at times. There may be some worry or constipation, but nothing worth taking serious notice of. On the night in question the patient went to bed as usual, and at some time after midnight severe pain in the head came on, the patient vomited and the eye became red and the eyelids swollen. For a number of years I have tried to find some explanation for the attack coming on at this particular time of night. It is only now when I become acquainted with Professor Arthur Thomson's views about the genesis of glaucoma (*Ophthalmoscope*, Vol. VIII (1910), p. 608), that I can satisfactorily explain the reason of this condition to myself.

Your European readers are doubtless fully familiar with Professor Arthur Thomson's valuable original work on the anatomy of the eye, but I may be excused if I give a brief outline of his theory for the benefit of some of your readers who are not acquainted with his theory.

In short, Professor Arthur Thomson has shown that posterior to the opening of Schlemm's canal there is a projection all round from the inner side of sclera. This projection he calls the scleral spur. In longitudinal section it is almost triangular in shape. To its anterior aspect or apex are attached the fibres of the ligamentum pectinatum. This ligament is elastic. To the posterior aspect or base of the spur are attached fibres of the ciliary muscle. During accommodation the ciliary muscle contracts and in so doing it pulls the scleral spur backwards, thereby pulling the walls of Schlemm's canal apart; whilst at the same time the ligamentum pectinatum is stretched. By widening of Schlemm's canal negative pressure is induced in it. This leads to an in-rush of aqueous in the canal from the iridic angle. Then follows the second part of the phenomenon. The ciliary muscle ceases to act. The pectinate ligament by its inherent elasticity tries to return to its normal condition, thereby positive pressure is brought about in Schlemm's canal. The fluid which rushed into Schlemm's canal during the time the pressure was negative in it is now subjected to positive pressure. It can no longer return to the anterior chamber as the scleral spur by returning to its former position closes the passage to the anterior chamber. The fluid can only pass to the anterior ciliary veins. In fact it is pumped on to the veins. This process is repeated every time the accommodation is brought into play; and fluid from the anterior chamber passes on to Schlemm's canal, thereby maintaining equilibrium of intra-ocular pressure.

Now it is quite plain that accommodation acts only during waking hours and it stops during sleep, and hence changes—brought about by the constantly altering conditions of accommodation—are no longer in action during sleep. How is it then that in normal conditions the equilibrium of intra-ocular pressure is maintained? It is possible either that the secretion of aqueous should be enormously diminished or stop altogether or that the work of excretion be carried on through some other channels. So far the physiologists have not proved that the process of secretion ceases during sleep nor have they demonstrated that it is diminished; on the other hand, we have reasons to believe that aqueous is secreted during sleep. The reasons I allude to are first, when a patient is under the effects of an anaesthetic and an incision is made in the cornea, the aqueous flows out, but if some time be allowed to pass the anterior chamber is filled in again. Let it be made clear that normal sleep is not similar in every respect to narcosis produced by an anaesthetic and that the emptying of the anterior chamber induces negative pressure in it and that thereby conditions favourable to the secretion of aqueous are produced which are far from being similar to the conditions in normal sleep. The second reason is that it has been proved that urine is secreted during sleep, and Mr. Treacher Collins has shown that histologically there is a certain amount of resemblance between the ciliary body and glomeruli of the kidneys; and hence it is quite possible that aqueous humour which is secreted by the ciliary body continues to be secreted during sleep. Now, under these circumstances, as the aqueous which is secreted can no longer pass on through Schlemm's canal during sleep, there must be some other passages through which it finds its way out under normal conditions. We know that there are two routes at least through which the aqueous can find an exit. These are through the crypts of the iris and the posterior route through lymphatic channels of Cloquet's canal.

In normal eyes, or in eyes not predisposed to acute glaucoma, this arrangement works smoothly, but in those eyes that are predisposed to acute glaucoma from one cause or another the comparatively scanty filtration is not adequate till morning hours when the patient wakes and the pumping mechanism can come into play again. As soon as the patient goes to bed the pumping mechanism ceases, aqueous collects in the posterior chamber; perhaps part of it forces its way into the anterior chamber and manages to pass through the crypts and thence to the veins. This inadequate arrangement allows a few hours after sleep to elapse before the effects of increased pressure in the posterior chamber begin to be felt. The increased pressure gives rise to venous engorgement which in turn makes the ciliary body and iris turgid. The iris and lens are pushed forwards and a vicious circle is established.

It may be worth while to mention here that during sleep the pupil contracts, hence this factor can be easily said to have no effect on the condition.

A DIRECT RECORD SCOTOMETER FOR INVESTIGATING THE CENTRAL FIELD OF VISION*

BY

N. BISHOP HARMAN,

LONDON.

DURING recent years increasing attention has been given to the investigation of the state of the central fields of vision. Observations made by such investigations are of value to the physician and to the ophthalmic surgeon. The physician is interested in the appearances of scotomata as indications of lesions of the optic nerves in organic diseases and in the various phenomena that may be elicited in functional disorders. The ophthalmic surgeon is interested in these observations also, and more particularly in the state of the blind spots in suspected early onset of chronic glaucoma. There is general agreement on the value of the field of investigation opened by the work of Bjerrum, but most will equally agree that these investigations are laborious in the extreme, and that not a little of their value is lost since the results tend to be vitiated by the occurrence of fatigue on the part of the patient owing to the lengthy process of the investigation.

The instrument illustrated is a simple and convenient arrangement for making and recording Bjerrum's test and mapping out central scotomata. I have had it in use for over two years, and find it a great labour-saving contrivance. Besides that, the speed with which the observations can be made ensures an accuracy of measurement which I do not think can be beaten. A permanent record of the observation is made at the same time as this is taken without any calculation on the part of the surgeon; and withal the patient sees and knows nothing of what is happening and is not distracted by a number of manipulations or changes of position by surgeon or instrument.

My first experience of Bjerrum's test was made in the fashion recommended by the author of the test: with a black sheet hung against a wall. I soon felt the need of getting behind the screen so as to be able to see the patient's eyes without interruption. I thereupon used a blackened disc of three-ply wood fitted to the ordinary perimeter stand, with the degrees, circles, and radii graven upon its surface. The object used was gummed on to the point of a lead

*Instrument demonstrated before the Section of Ophthalmology, Roy. Soc. Med., on January 14, 1921.

pencil, so that its movements could be recorded by the marks of the pencil on the blackboard. The method was quick and accurate, but had the serious disadvantage that the record had to be copied on to paper, a duty one was apt to forget on occasions. After that I tried thin sheets of tracing paper fastened to the blackboard, so that the paper received the direct record of the observation. But this had to be discarded, for the patients saw what was being done. One patient brought me a sheaf of observations of his blind spot he had made himself; it is not desirable that neurotic glaucomatous patients should become habitual field-takers. Thinking to take the record on black paper, a handy piece of typewriter carbon was made use of, so that the form of recorder you see came about.

The carbon recorder has a real advantage in the fact that a continuous record of the movements of the object may be made throughout the observations by lightly dragging the pointer over the screen and pressing it upon the screen when it is desired to make heavier marks at salient points.

The screen is fixed to a stout iron frame. This can be shut down when not in use, but it is rigid when set up. There are no loose pieces, screws or joints, to be fitted together. The screen is of a dark grey cloth mounted on a wooden frame, chart and carbon are slipped behind the screen and the whole clamped in the frame. The frame slips on to the higher of the two uprights of the stand. The other upright ends in a ball against which the patient presses the side of his nose close to the cheek; he holds the upright with one

hand and covers the eye not under observation with the other. The fixation spot is marked on the screen by a white metal stud fixed into the cloth. The position of the blind spots are marked at the back of the frame by two knobs, one or other of which the surgeon holds as a guide so that no time is lost in finding the working areas. These knobs are most useful, they give such a sense of position that after a little experience it is possible to keep one's eyes fixed upon the patient's eyes during the whole series of observations, the feel of the knob at the back of the frame giving sufficient guidance for the movements of the object-holder in the other hand.

The surgeon stands behind the screen, holds a knob with the left hand, his right hand is enveloped in a black bag, and the object-holder projects from the hand through a hole in the bag. The object-holder is a rod fitted in a convenient handle to be held pen fashion. At the free end of the holder is fitted a small carrier with the object; at the back of this is fixed a blunt pointer which is moved over the face of the screen and pressed upon it when desired.

The chart measures 12¾ in. by 8 in., i.e., it is foolscap size, which at 33 cm. gives a range of 26 degrees laterally and 17 degrees vertically from the central fixation spot. The shape of the chart is determined by the size and shape of the typewriter carbons which are only made in certain sizes. I have found this chart of ample size, giving all the range that is required for such observations. A chart on so large a scale as this allows the use of the same sheet for several examinations of one patient at different times. Different coloured carbons are provided to distinguish the several records; by this means valuable comparison is provided.

The working distance of 33 cm. is the working distance of our best-known arc perimeters. I find no advantage in a longer working distance, but a shorter distance than 33 cm. is liable to introduce complication by reason of shadows from the patient's head.

The real advantage of this recording instrument is the speed and accuracy with which observations may be made. I find that in such work speed and accuracy are almost synonymous. My observations have convinced me that to get accurate results the work must be done so quickly that the patient does not get tired and let his eye wander from the fixation point. If in taking his records the surgeon has to move about, take notes, shift the instrument, or do anything which takes time, or diverts the patient's attention, accuracy of observation is seriously diminished, if not lost. I have taken a series of observations in measuring the blind spot of one of my own eyes, repeating the measurements one after the other without interval for rest. It was found that the fifth or sixth mapping was slightly larger than the first, and after that fatigue made a delineation erratic.

The instrument has been well made by Messrs. John Weiss and Son, Ltd., London.

ABSTRACT

I.—VOGT'S CATARACT

Gjessing, Harald G. A. (Drammen, Norway)—Examination of the lenses in reference to cataract of the type known as "Vogt's." (Untersuchung in Maximalmydriasis von 4,768 Augen im Alter von 3 Monaten bis zu 87½ Jahren mit punktuell abbildendem Licht und zwar in besonderen Hinblick auf die Vogtsche sog. Koronarkatarakt.) *Klin. Monatsbl. für Augenheilk.*, Aug.-Sept., 1920.

Gjessing, an ardent worker and one of the most promising ophthalmic surgeons in Norway, contributes a long and careful paper regarding his laborious studies of the lenses of nearly five thousand eyes, with the view of clearing up questions relating to that form of cataract which has been known to some as Vogt's, or coronal. He employed complete mydriasis and the most precise methods of investigation, by means of Gullstrand's lamp and Zeiss's corneal microscope. Originally described by Harald Philipsen in 1874, this form of "cataract" was really first investigated thoroughly by Vogt, who emphasized its frequency even in youth, its characteristic situation, and its typical appearance. Under powerful illumination, as seen on magnification twenty times, and still more beautifully with yet higher magnification, the aspect is that of shagreen, the tiny rounded areas of deeper haze arranged as it were in a careful and regular fashion. The appearance must not be mistaken for that presented by the physiological "sutures" in the lens, nor for that of striae. It gives the impression that the little areas reflect more light than do the elements which lie alongside; and the question arises: Where precisely is the site of this shagreen-like material? Hess expressed the view that it is produced by the epithelium of the anterior lens capsule, and employs both the changes in it and in Purkinje's images in the explanation of the altered state of the lens during accommodation, but Vogt would include also the anterior fibres of the lens itself. He founds his opinion upon the form of the formation and upon its grouping in relation to the course of the lens fibres as well as upon the manner in which its image is thrown upon the posterior capsule. Gjessing was not himself able to confirm this view, at least in a number of his cases, and as there is no epithelium on the posterior surface, he is, perhaps, right in regarding this as a crucial point. Further, it can be seen sometimes on the fragments of capsule removed by capsulotomy, and it is fairly certain that at any rate it is the

epithelium which plays by far the more important rôle. The shagreen appearance is best made out when one investigates a case of commencing cataract under the Nernst lamp with a moderately dilated pupil at an angle of about 40°. With this arrangement the sub-capsular portions of the lens are strongly brought into view against the falling shadow; but when the light is allowed to fall more directly, and the corneal microscope is focussed upon the situation of the shagreen, the aspect comes and goes rapidly. It then becomes certain that only the very superficial portions are in any way involved in the formation.

In addition, there may sometimes be observed the so-called shagreen globules, to be found usually in elderly persons and in lenses which have become cataractous; to bring these into view it is best to throw upon the shagreen area not too sharp illumination. Their situation is in the intermediate zone of the lens, and they are rare in children. The globes are rather "large"; they are arranged in groups, but never become confluent; they are invisible with the ordinary loupe. In certain other cases similar, but slightly varying, appearances are observed, and regarding the whole matter, the author considers that Shürmann's estimate of their occurrence in 33 per cent. of all the eyes he examined is rather too high; he himself would put it at 15 to 20 per cent. But, as he says himself, since his results in their essentials agree with those of the Swiss observers Vogt and Lüssi, it may well enough be the case that the variation in incidence is due to racial differences. As other instances of variations, he mentions that he observed the globules or rounded formations in the shagreen much less frequently than the Swiss, and the same applies to the "watershed" or "roof-ridge" form of irregularity of lens surface, and to the "hump" or wheal. For all that, he finds that quite apart from formation of cataract, the surface of the lens of the aged Norwegian is rarely quite smooth; a formation resembling fir-twigs or needles was moderately frequent.

The author does not quite agree with Vogt in his views as to the closeness of relation between inspissation of the nucleus and increasing yellowness or brownness of the nucleus, on the ground that some really old people have cataract with the nucleus almost free of any colour, while relatively young patients may have deep tinting of the nucleus. Of the red and green iridescence of the anterior layers, and, indeed, in complicated cataract of the posterior layers also of the lens, the author has not found any typical instance among his cases.

In regard to etiology, he has not discovered any support for the theory that cataract is caused by the presence of indican or other abnormal contents in urine or in alimentary tract. In a paragraph dealing with the structural changes occurring with advancing years and commencing cataract, he warns us against being too ready to decide that the refractive state of the different lens-portions is

in excess of the normal, for much depends in a case such as this upon the personal equation, to say nothing of variations in the same lamp on different occasions. The refractive index increases with age, and there occurs along with, or even prior to, the first formation of lens opacities a diminution in the fluid content of the lens fibres, so that they become more strongly refracting. It is possible that the false opacity seen occasionally after an injury may then have its origin in a temporary diminution of the fluid content of the anterior lens fibres.

It is in the age period, 46-50, that the fluid-containing fissure *(Wasserspalte)* first is in evidence, and it occurs with increasing frequency in the more advanced periods; while these are most usually to be seen in the superficial layers, they are found also in the nucleus. They are a fairly reliable, but not a certain, indication of a tendency to the formation of cataract. His observations corroborate those of Vogt, that the typical cataract (*Kranzstar*) never begins immediately subcapsularly, but is always separated by a definite interval from the anterior surface of the lens. Punctate cerulean cataract he regards as being usually congenital and non-progressive. He is inclined to regard both the onset and the period of cessation or decline of sexual life as having a slight but distinct influence in the development of cataract.

Speaking of the precise situation of the opacities, Gjessing agrees that the lower quadrant is most usually the first affected, and that opacities much more rarely are confined at first to the posterior than to the anterior portion of the lens, but he does not consider that there is sufficient evidence to attribute cataract to the injurious influence of the ultra-violet rays acting on the albuminous substance.

The possible influence of certain general diseases in the incidence of cataract was investigated, but his results among the cataractous and the cataract-free persons do not show any convincing discrepancies. He remarks that among 387 women with cataract 48 per cent. had passed through complete pregnancies (from one to fifteen times) and 13 per cent. had had one or more miscarriages), while among those with clear lenses 15 per cent. had borne children, and 3 per cent. had had miscarriages. He naïvely observes that from motives of propriety he refrained from questioning his unmarried patients as to pregnancies and miscarriages! It is known that when the ovarian function is in abeyance there comes a rise in the calcium and cholesterin content of the blood, and it is quite possible that this alteration during pregnancy and lactation may have at least some little influence in the incidence of cataract. The proportion of women patients with cataract under 50 relative to men of the same age is somewhat higher, but he does not say whether he has collated these results with the numbers of the two sexes in the population.

After discussing some other points of minor moment, including

the question of the influence of errors of refraction, Gjessing expresses the view that it is not so much high myopia itself which tends to be the cause of cataract in such an eye, as the choroidal changes which occur along with and accompanying the myopia. He mentions with approval the theory (so far as his cases will take him) that central senile choroiditis, so far from tending to cause cataract, seems to protect from it, but that this is emphatically not the case in other forms of irido-choroiditis. Further, whenever the margin of the iris showed marked degeneration, then cataract was sure to be observed also.

He interested himself further in the question of coloration of the eye as related to the incidence of cataract; but, as might have been expected, comes to no certain conclusions there anent; the same remark applies to "colour" and visual acuteness, and to the greater or less visual capacity as between male and female patients—apart from such complicating occurrences as pregnancy and lactation.

In regard to the urinary condition, it is well known that sugar tends to the formation of cataract even when the actual amount present is in itself trifling. Among his cataract patients Gjessing found 13.5 per cent. with albumen in the urine; unfortunately, he was unable to examine systematically for tube casts.

W. G. SYM.

II.—SYMBLEPHARON

Wilder, William H. (Chicago).—**Symblepharon and restoration of socket.** *Amer. Jl. of Ophthal.*, November, 1919.

Wilder describes how the condition of total symblepharon, which was regarded as hopeless by the earlier ophthalmologists, is capable of much improvement, if not complete cure, by means of tissue-grafting and mechanical preservation of the culs-de-sac.

Deformity is due to the development of constricting bands of fibrous tissue, and plastic interference should take place as early as possible in the course of healing. As soon as the wounded surfaces are clean and granulation has begun, suitably prepared plates are inserted in the conjunctival sacs. These plates consist of very thin block tin coated with a thin layer of paraffin of high melting point (130° F. or over). These plates prevent adhesion of the lids to the eyeball, and the coating of paraffin protects the cornea from injury in cases in which the globe is intact. When the healing process is satisfactory this graft tissue is placed on the plate, being held in position, if necessary, by means of sutures. The graft

tissue ought to consist of mucous membrane, but thin Thiersch grafts from the less hairy parts of the skin may be employed.

If the cornea have been denuded by the injury, time should be allowed for the corneal epithelium to repair before application of the graft in this region.

In simple cases conjunctival flaps may be possible with which to cover the raw surface after division of the symblepharon, but in the more severe cases mucous or epidermal grafts will be required, and these must be held in position by conforming plates. In severe injuries with loss of eyeball, dermal grafts may be used, and the external canthus may have to be divided.

Grafts should be much larger than the area to be covered. In dissecting the eyelid from the eyeball, it is necessary to keep the lid as thin as possible, and dissect deeply in the fornix. In the case of preparation of the socket for a prothesis, the lids must be dissected free from the underlying tissues of the orbit and the whole cavity lined with epithelium.

Dealing with the work of others on the subject, Wilder mentions the device of Poulard and Réal for dilating the cul-de-sac and preventing the formation of obliterating fibrous bands. The apparatus consisting of a plate fashioned from a wax model of the orbit is kept in place by means of a metal arm attached to a forehead strap.

Morax, after detaching the lids in this form of flaps stitches them to the skin above and below the orbit. He covers the everted surface with epidermal graft-tissue. At the end of three weeks these flaps are brought together and united by suture over a plate of enamel or lead. They remain thus for at least six weeks, when the socket is ready for the prothesis. Pedunculated flaps of skin from the adjacent parts have been employed to clothe the orbital surfaces, and restore the culs-de-sac; in all these methods Wilder recommends the use of a conforming plate to keep the flap in position. The paraffin-covered plate forces the graft into every part of the cavity, and the cavity can be irrigated through the openings in the plate.

During preparation for a prothesis some form of plate should be worn for several weeks after grafting is complete, in order to retain the shape of the socket as desired. Special artificial eyes must be made to fit irregular sockets, in order to avoid undue pressure at certain points.

NOTE.—The author does not mention the valuable work of Valois, as embodied in "Les Borgnes de la Guerre." Valois employs an olive-shaped body for the preservation of the newly-made socket. He is emphatic on the point that there must be no *forcible dilatation* of the cavity by mechanical contrivance.

J. HAMILTON MCILROY.

CORRESPONDENCE

SMALL FLAP SCLEROTOMY

To the Editor of THE BRITISH JOURNAL OF OPHTHALMOLOGY.

SIR,—It is impossible briefly, and at the same time adequately, to answer Colonel Elliot's criticisms in the January issue of the Journal, of my paper published in December, 1920. But my reply will be direct and to the point, as we are agreed that truth is best served by plain speaking.

Colonel Elliot rejects true filtration through spongy cicatricial tissue as opposed to everything we know of the behaviour of scar tissue. What do we know histologically of the healing of eye wounds bathed in aqueous? Not very much as yet. "Indisputable anatomical material" to demonstrate true filtration is not likely to be obtained except by some rare chance, from an operation not very generally practised. Fortunately, it does not appear to be very necessary (see below).

There follows a remark questioning the existence of drainage through the wound of which a section was shown in my paper. Colonel Elliot's criticism is that the description "would deceive no one but a tyro." The statement that there was a quite good area of oedematous conjunctiva over the wound was given in inverted commas to show that it was supplied by the able pathologist who kindly gave me the section. Coupled with the clinical appearances now well established in perfectly successful small flap sclerotomies, the definite conjunctival oedema over one of these sclerotomy wounds, which is seen to be gaping well and filled with loose tissue, must be taken nowadays as demonstrating conclusively true filtration. In this case the drainage was insufficient to counterbalance complete obliteration of the filtration angle of the eye; otherwise the specimen would not have become available. Though the drainage was almost certainly merely temporary, this temporary filtration seems to me to give in all probability a very fair representation of permanent true filtration. Anyone is at liberty to reject this opinion, but not, I consider, to deny the existence of filtration in this case at the time.

Of sclero-corneal scars that are hidden under opaque swollen conjunctiva, naturally no one can affirm anything absolute, though there is good reason to believe that this grade of conjunctival oedema always predicates an underlying fistula. But it is quite a mistake to argue from these invisible scars, as Elliot does, that "it is not possible to say from the mere inspection of a scar that it is not fistulous." This mistake is an example that the trouble that

may arise from unnecessary confusion between the sclero-corneal scar and the secondary conjunctival changes over it. This confusion is commonly made in talking loosely of "bleby" or "vesicular" cicatrices, but without leading to trouble, since the underlying scars are then more or less visible. Truly filtering cicatrices are generally so clearly visible through the nearly normal conjunctiva, that one is able to examine them minutely without the least trouble.

Much misconception would have been avoided if more time and trouble had been expended on methodical careful examination of the results of glaucoma operations, with focal illumination and a + 20 lens. I am firmly of opinion that such clinical inspection alone of the typical cicatrix of small flap sclerotomy is sufficient to convince an unprejudiced observer of the reality of true filtration. The perfectly uniform grey tissue is there clearly to be seen in the scar lines, which vary only in width, being often broadest at the end of the flap. Seeing this, one could not possibly accept Colonel Elliot's supposition that when "a mere sclerotomy provides a permanent filtering scar," it does so by complete absence of healing. Elliot clings to the idea of all or nothing in this matter. Nature does not work on these hard and fast lines; it is rather a question of degrees, more or less. One cannot apply the observation of the cut iris remaining unhealed, unreservedly to wounds in the cornea and sclera. For instance, in some trephine holes there may certainly be partial healing, just as there may in other cases be complete healing. The last two trephined eyes which I have seen (in one patient) exemplify this. The scleral openings had become filled or covered by white fibrous tissue, not smooth and even, but apparently in coarse strands. Drainage was shown by well-marked widespread oedema, and by a little localized, partly transparent, elevation over the trephine spots. Plus tension had returned six years after operation, unmistakably in one eye and less markedly in the fellow eye. I do not suppose that any recent change had taken place in the scars; presumably the leakage was no longer sufficient to counterbalance advancing glaucomatous changes in the eyes.

To Colonel Elliot "the presence of this connective tissue in a wound is an indication that that wound is no longer absolutely aseptic." I am sure that this suggestion will find no support in the experience of the vast majority of eye surgeons. Applied to my own work, it would mean that all my best results for many years had been obtained through mild infection.

To Colonel Elliot I seem to have attempted to make facts fit in with preconceived theory. To my mind there has been nothing in my glaucoma work but patient and laboured clinical observations continued over many years, together with some simple deduction and attempts at practical application.

I am not wholly an "antagonist of sclerectomy," and have at times been glad to switch on to some form of it. For instance, it may be a simple matter to excise the posterior lip of a keratome incision, fixed by fine forceps; the cutting from without inwards can readily be done by sawing with a Graefe knife. I have seen most admirable filtering cicatrices from Lagrange's operation. But it is otherwise with trephining.

In the prevention of late infection through iris-free leaking scars, our aims may be summarized as follows:

(A) One of the chief aims is to promote wide diffusion of aqueous under the conjunctiva. This may be attained (1) by a sclero-corneal wound which reaches the scleral surface at a little distance behind the conjunctival limbus, where the conjunctiva is thick and loose. Also (2) by extending the wound in a line parallel to the corneal margin. And (3) by the avoidance of adherent conjunctival scars.

(B) Apparently of equal importance is restriction of the flow of aqueous by limitation of the size of the sclero-corneal opening. In the milder glaucomas particularly, in which true filtration has been found fully effective, restriction of the flow of aqueous may be obtained also by securing this form of leakage, rather than drainage through a definitely fistulous opening. This is secured by making the sclero-corneal wound narrow, the required leaking area being got by length rather than breadth.

(C) By true filtration also we may hope directly to prevent deep penetration of surface organisms, the latter being held in the spongy tissue.

The very antithesis of A (1) and (2) is reached in a round hole beneath the thin adherent limbus. And apparently some trephine holes may be thus described, and therefore held in these respects to be the worst possible form of sclerectomy, entailing the maximum risk of infection.

Never having seen any of Colonel Elliot's results, I am at a disadvantage in commenting on his work, but his clear descriptions seem to afford ground for the following remarks.

He has undoubtedly improved matters greatly by the well-known splitting of the cornea. A conjunctivo-corneal flap is raised, consisting purely of the superficial corneal layers at its base. Since the splitting of the cornea is begun as far back as possible, after the definition of the conjunctival limbus (see pages 453 and 455 of Elliot's Text-book), we may conclude that a thin layer of corneal tissue is commonly included immediately beneath the limbus, strengthening it.

If the cornea is split as far as 1.75 mm. from its margin, and full advantage is taken of this corneal reflexion in applying a 2 mm. trephine, it seems obvious that half or more of the trephine hole

must be afterwards covered by the corneal tissue thus included in the conjunctivo-corneal flap. (I do not understand Colonel Elliot's bewilderment over my reference to this matter.) What becomes of this corneal covering? I suggest that little or no aqueous filters through this comparatively firm tissue, and that the fluid passes forward mainly or entirely through the part (half or less) of the trephine hole which is covered only by conjunctiva. If this is so, the passage for fluid is narrowed to a semi-circle or less, i.e., a gap with a maximum length of 2 mm. and maximum breadth of 1 mm., situated immediately behind the conjunctival limbus. And I suggest that this fact may account largely for the superiority of Elliot's own results, as compared with those of some other trephiners, and with those got by Holth's punch operation. But obviously such an opening falls far short of the possibilities under A (1) and (2). By other means one can easily make a decidedly longer opening, and place it further away from the corneal margin.

I do not know if any eyes have been removed after trephining in which full advantage has been taken of extensive splitting of the cornea. It would be interesting to note the changes in the corneal layers which formed part of the corneo-conjunctival flap.

Elliot's sole or main object in splitting the cornea appears to be the placing of the trephine opening well away from the ciliary body. For the prevention of late infection he lays particular emphasis on the inclusion of all the sub-conjunctival tissue in his flap. But both conjunctiva and sub-conjunctival tissue are sometimes very thin near the limbus. In my own practice I well remember producing one of the worst possible blebs in a case where the conjunctiva and sub-conjunctival tissue had not been disturbed at all over the sclero-corneal opening. The latter had resulted from the stretching with forceps of a small puncture, made by a bent broad needle after sliding the conjunctiva.

A circular sclero-corneal opening being of all wounds the one tending most to fistulization, as opposed to true filtration, it is necessarily the worst possible form of wound as regards the aim (C) above.

I have never regarded small flap sclerotomy as ideal; it fails too often to give the desired result in severe advanced glaucoma, as I found in India. Yet in many of the primary glaucomas of this country it gives a quite ideal result, safe and lasting. For these particular cases, therefore, it may be accepted as a perfect method. And there seems every reason to define and to enlarge, as far as possible, the group of glaucomas in which it serves best. I feel sure there are ways not touched upon in my recent paper, of rendering the result of the operation more certain.

It was largely, but not wholly, on personal experience that my statement was based, regarding the indifferent success which seems

to have rewarded our attempts to graduate leakage in accordance with the needs of the case. I readily believe that the dangerous conjunctival blebs with hypotony, which betoken excessive leakage, may have been rare in Colonel Elliot's hands. Yet he has insisted both at the last Oxford Congress and again now, that some risk of infection must be accepted as inevitable with all the modern *successful* glaucoma operations. I would certainly agree with this opinion if we had no resource but iris-free fistulization. It seems fairly well established that in many of the severer chronic glaucomas the flow of aqueous needed for full relief of tension is so great that it cannot be obtained by iris-free drainage without risk, sometimes perhaps considerable risk.

In conclusion, it is well to bear in mind that only one of the two chief defects of drainage by fistulization has been discussed above. The value of this form of drainage must depend very largely on the question of the permanence of relief of tension provided by the smaller fistulae, yet to be decided.

I hope to bring up the question of the treatment of glaucoma by iris-prolapse at the Ophthalmological Society's Congress in May.

Yours truly,

H. HERBERT,
Lt.-Colonel, I.M.S.

A SCHOOL OF OPHTHALMOLOGY FOR LONDON

To the Editor of THE BRITISH JOURNAL OF OPHTHALMOLOGY

SIR,—I must confess to a feeling of disappointment that the admirable suggestion made by Mr. M. S. Mayou in the February number of the Journal has not met with the open endorsement of readers. He practically proposes to amalgamate and to co-ordinate "The principal leading schools attached to the ophthalmic hospitals in London" for teaching purposes. I write in cordial agreement with Mr. Mayou. When I first came to London, tolerably acquainted with clinical and operative eye work, I hastened to attach myself to one of the ophthalmic hospitals, not one of the least well reputed. The teaching based on actual clinical material could not well be beaten, but when I began to look about for tuition in pathology I found that although a gentleman bore the title of "pathologist" to the institution, I had never seen him, and though well acquainted with the hospital premises, failed utterly to locate his habitat. As a result I was compelled to seek pathological instruction elsewhere. Again, as to optics, no attempt was made at the hospital in question to instruct students in what I knew to be from my text books an important subject. Accordingly, I was driven to attend

the class held, presumably for opticians, at The City and Guilds Institute by the late Professor Sylvanus Thompson. I was well rewarded. A properly equipped ophthalmic school should obviously lay itself out to teach, not only ophthalmology, but the ancillary sciences as well.

Later, when settled in practice, and having visited many ophthalmic clinics, both upon the Continent and in America, it occurred to me that the weak point of the present system in London might be closely connected with the fact that the school was always an adjunct to the hospital and that better results might perhaps be obtained by reversing the relationship. I imagined an institution, a school of ophthalmic technology, provided with teachers, skilled in all the auxiliary branches of ophthalmology, with optical and bacteriological laboratories and with a small out-patient department and a few beds, enough to give means for adequate clinical instruction and no more. Such a plan would not be expensive to create, and the fees charged afterwards should make it self-supporting. The qualification of a teacher should be one, namely, that he knew how to teach.

Yours, etc.,

WELBECK STREET, W.
March 9.

SYDNEY STEPHENSON.

AN INTERNATIONAL CONGRESS OF OPHTHALMOLOGY

To the Editor, THE BRITISH JOURNAL OF OPHTHALMOLOGY.

DEAR SIR,—Owing to a misconception on the part of some as to the exact character of An International Congress of Ophthalmology, which is to be held in Washington, D.C., April 25-28, 1922, I am instructed by the General Committee to prepare the following notice and to request its early publication in the Journal:

First, the proposed Congress is designated as An International Congress of Ophthalmology, which will be held under the auspices of the American Ophthalmological Society, the Section on Ophthalmology of the American Medical Association and the American Academy of Ophthalmology and Oto-Laryngology. It is an independent Congress and is in no way affiliated with, or a continuation of, the regularly constituted International Congress of Ophthalmology which has convened at regular intervals in the past, the last session of which was to have taken place in St. Petersburg in 1914 at the outbreak of the war.

Second, because of unavoidable complications in the arrangement of the proper and comfortable accommodations for the delegates of

the Congress, it has become necessary to change the date of meeting from April 18-21, 1922, as previously announced to April 25-28, inclusive, 1922.

Very truly yours,

PHILADELPHIA.
March 1, 1921.

LUTHER C. PETER,
Secretary.

BOOK NOTICES

The Microscopic Study of the Living Eye. (Etude Microscopique de l'Oeil Vivante), continued. By GALLEMAERTS (Brussels) and KLEEFELD (Brussels). *Annales d'Oculistique*, Vol. CLVII, February-March-May, 1920. (Paris: G. Doin. Published in 1920 as a separate volume.) Eleven plates, comprising 44 figs., about half of which are in colours.

The present series of articles by Gallemaerts and Kleefeld deals in detail with the results found on the examination of the various eye tissues by the methods therein described. The whole forms a very interesting contribution to the study of changes in the living tissues, difficulties arising in two directions—first, data for comparison collected by other observers are scanty, and, secondly, the method of reproduction of the appearances presented suffers from the want of precision, some of the drawings that are reproduced not being very convincing. Separate chapters are devoted to cornea, conjunctiva, sclerotic, anterior chamber and iris angle, iris, lens, and vitreous, while the figures cover diverse conditions, congenital and acquired, the examinations showing that relics of the pupillary membrane and fine opacities of lens are much more common than ordinary routine examinations have hitherto shown.

Oedema of cornea and striate keratitis give interesting findings, while the directing of a pencil of rays on an oedematous cornea frequently causes this opacity to clear up, and so permit of a crisp view of iris beyond, suggesting that the opacity is due to imbibition. Special alterations of the method of illumination are needed to show up the features of the corneal vessels, these having to be distinguished with difficulty from the termination of the scleral lamellae, the radial lymphatic vessels and the limbal bloodvessels, and, to a less extent, from the nerve filaments. Special features belong to superficial, middle, and to deep vascularisation of the cornea in disease, the middle variety being that seen in interstitial keratitis, while the deep is found in injury cases to herald the approach of atrophy of the globe. Details are given of the various deposits met with on the back of the cornea, the cellular, including the white cells seen preceding iritis, red blood cells after contusions, in luetic

iritis, and tubercular iritis, and in traumatic iridocyclitis, and reddish-brown pigment having a rough appearance; the non-cellular, including haematoidin and cholesterin crystals and various deposits derived from fibrin; details of these appearances in relation to the different diseases are given. These various deposits occur together in different proportions, and their abundance is not in direct relation to the gravity of the disease. The peculiarly confusing appearances produced in the middle and deeper layers of the cornea after cocain drops, and those seen after holocain has been used for tonometry are described.

Corneal ulcers are said to present no features worthy of attention, but in these cases the nerves of the cornea are found to be very visible.

Epithelial dystrophy is found much more frequently since the use of these higher magnifications and usually precedes a lymphatic keratitis, while it also precedes an eczema of lids and later of face.

In herpes of the cornea, whether febrile or zoster, the high power appearances are the same. Three stages can be noted: the first or "invasion" stage—this is not a superficial affection of cornea, but a mesodermic one with consecutive lesions of epithelium and endothelium, the most important and most constant lesions being extreme congestion of iris and corneal oedema. The very earliest stage of invasion is not seen because it is only when the epithelium sheds, that pain directs the patient to the surgeon. In the early stages, the corneal surface presents generally bullae of various sizes, more or less polygonal, quite large, and usually elongated with the axes of the bullae not corresponding to any corneal radius, and so not to the course of any nerve filaments. These bullae are surrounded by a zone of oedema, extraordinarily intense, which appears to consist of a continuous series of very small greyish, almost white, points. The demarcation between this grey zone and the corneal tissues around is not clearly defined, but the grey zone shows tongue-like projections radiating to the healthy tissue. The zone where the demarcation occurs is quite typical. The floor of the ulceration is very slightly beneath the corneal surface and there one sees a very fine amorphous exudate, through which the corneal tissue seems greyish and peppered over with fairly regularly disposed discrete points, which appear darker than the surrounding tissue, a sort of fine craters limited to this desquamated zone. The epithelium, curled up like a roll of parchment, does not seem to have suffered any change, but the border of the ulcers has a series of rectilinear segments. At this period the endothelium is already markedly altered—the most beautiful pictures of false striation of posterior surface of cornea, large cracks, veritable fissures, being seen to traverse this area in all directions. The direction, situation, and number are quite independent of the epithelial lesions. The

processes seen in both epithelium and endothelium are of a trophic order, their death and desquamation allowing imbibition of the corneal lamellae.

The second stage, that of establishment of the disease, shows itself by a fresh crop of bullae, then ulceration, whilst the striation and corneal oedema increase. The epithelium grows over the older ulcerations, but the infiltrated zones persist. One gets the impression of an extremely violent process, which ends in the loss of the cornea.

The iris is more and more congested, the typical deep vessels invading the marginal zones of cornea at the same time as the superficial vascular loops push forward in all directions.

The third or reparation stage. Suddenly the oedema of cornea disappears and with it the infiltrated zones of striate keratitis. The cornea is quite transparent in the non-ulcerated zone. Little by little the epithelium grows over the ulceration, which finally disappears, leaving the typical nebula.

This detailed description, as given, of herpes of the cornea will serve as a sample of a paper which would need to be read in the original and studied with the figures supplied.

Gallemaerts and Kleefeld have discovered a new condition which they have called waxy degeneration of cornea. In their one case the appearances at first suggested a mycelium, but the high power view disposed of this idea. Opposite the palpebral fissure, about the middle of the cornea, was a whitish zone, amorphous and translucent, deliminated by an epithelium rolled up like parchment, a zone which was less sensitive than the rest of the cornea and readily yielded to scraping, so far not recurring.

In siderosis bulbi the cornea shows a characteristic appearance, the visibility of the arachnoid corpuscles all over the cornea being markedly increased, these being coloured light yellow-brown, whilst the intervening substance remains normal.

In keratoconus the posterior surface of cornea shewed folds of Descemet's membrane, sometimes radial, sometimes concentric, the corneal nerves here again being very conspicuous.

The authors think it possible that with further development of intra vitam staining, this high power examination of the living eye may yield hitherto undreamt of results, and they consider that, even as it stands, the method they describe places our speciality in the vanguard of medical science.

W. C. SOUTER.

Transactions of the Ophthalmological Society of the United Kingdom, Volume XL., 1920. London : J. & A. Churchill. Price 30s. net (Postage 1s.)

This handsome volume of six hundred and twenty-six pages comprises the proceedings of the Ophthalmological Society of the

United Kingdom during its fortieth session, April-May, 1920. It contains, in addition, some of the papers read before the affiliated societies, namely, Midland Ophthalmological Society, North of England Ophthalmological Society, Oxford Ophthalmological Congress, Irish Ophthalmological Society, and Ophthalmological Society of Egypt. One affiliated body, The Scottish Ophthalmic Club, makes no contribution. It includes, as usual, many valuable contributions to ophthalmology. Its publication has been delayed by the preparation of the decennial index, 1911-1920. This most useful feature is incorporated in the present volume. Volume XL has no coloured illustrations, such an attraction in former volumes.

S. S.

NOTES

The Royal Society

READERS of the Journal will be interested to learn, that of the fifteen names recommended by the Council of the Royal Society for election to the Fellowship, one is that of Mr. J. Herbert Parsons, C.B.E.

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The Ophthalmological Society of New South Wales

THE following office bearers have been elected for the ensuing year: President, Dr. Gordon McLeod; Vice-President, Dr. Guy Antill Pockley; Honorary Treasurer, Dr. J. F. Halliday; Honorary Secretary, Dr. J. J. Kelly; Members of Council, Dr. R. H. Jones and Dr. E. A. D'Ombrain.

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A Course of Neurological Ophthalmology

A SPECIAL course of lectures and demonstrations in neurological ophthalmology will be given at the National Hospital for Paralysed and Epileptic, commencing in May, if a sufficient number of entries are received. The course will be suitable for candidates for the Diploma of Ophthalmic Medicine and Surgery. To candidates taking the full post-graduate course an additional fee of £2 2s. will be charged. For those taking the ophthalmic lectures and demonstrations alone the fee will be £3 3s. For further particulars apply to the Dean of the Medical School, National Hospital, Queen Square.